Pre- and Post-Processing for Cosmic/NASTRAN On Personal Computers and Mainframes

by
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Abstract

An interface between Cosmic/NASTRAN and GIFTS has recently been released, combining the powerful pre- and post-processing capabilities of GIFTS with Cosmic/NASTRAN's analysis capabilities. The interface operates on a wide range of computers, even linking Cosmic/NASTRAN and GIFTS when the two are on different computers. GIFTS offers a wide range of elements for use in model construction, each translated by the interface into the nearest Cosmic/NASTRAN equivalent; and the options of automatic or interactive modelling and loading in GIFTS make pre-processing easy and effective. The interface itself includes the programs GFTCOS, which creates the Cosmic/NASTRAN input deck (and, if desired, control deck) from the GIFTS Unified Data Base; COSGFT, which translates the displacements from the Cosmic/NASTRAN analysis back into GIFTS; and HOSTR, which handles stress computations for a few higher-order elements available in the interface, but not supported by the GIFTS processor STRESS. Finally, the versatile display options in GIFTS post-processing allow the user to examine the analysis results through an especially wide range of capabilities, including such possibilities as creating composite loading cases, plotting in color, and animating the analysis.

Introduction

The newly released interface between Cosmic/NASTRAN and GIFTS allows the user to combine GIFTS' pre- and post-processing capabilities with Cosmic/NASTRAN's analysis capabilities.

GIFTS pre-processors have a wide range of general-purpose capabilities for constructing and loading models interactively or automatically. Beam, spring, membrane, plate, shell, axisymmetric, and solid elements are available. Post-processing capabilities in GIFTS allow user-controlled display of displacements and stresses, beam shear and moment diagrams, deflected shapes superposed on undeflected, alphanumeric tables, and selected labels, element types, or portions of the model. GIFTS can also display plots in color and animate analysis results. The procedures for employing these capabilities are discussed below.

GIFTS and its interface with Cosmic/NASTRAN run on a wide variety of computers, including the IBM-PC AT and XT and their compatibles; larger IBM machines using CMS; VAX, Data General, and PRIME computers; and some UNIX implementations. It is possible to install both GIFTS and Cosmic/NASTRAN on the same computer (a VAX, for instance), or on different computers (say, a large IBM and a PC-AT). Thus the combination is well suited for networking.

The GIFTS-Cosmic/NASTRAN interface takes the form of two central programs: GFTCOS, to extract data from the GIFTS Unified Data Base and create ASCII input files for Cosmic/NASTRAN, and COSGFT, to return results obtained in Cosmic/NASTRAN to the GIFTS data base for post-processing. (A third program, HOSTR, assists with stress calculations for higher-order elements.) This interface supports many of Cosmic/NASTRAN's elements and features, and is scheduled for constant expansion updates to make use of new features in both Cosmic/NASTRAN and GIFTS. For instance, at present the interface supports both static analysis and vibrational mode extraction, with transient and buckling analysis expected in the next release.

Using the Interface

Before executing GFTCOS, the user constructs the desired model in GIFTS and assigns the desired loads and boundary conditions. The pre-processor BULKM (or BULKS for solid models) is used for efficient automatic mesh generation, with detailed editing capabilities available in EDITM (or EDITS). BULKF automatically suppresses degrees of freedom inappropriate to the model as constructed, and OPTIM optimizes the half-bandwidth, an essential step in preparing the model data for the interface. BULKLB and EDITLB (LOADS for solids) are then available for detailed application of loads, temperatures, and boundary conditions.

GFTCOS first examines the model for elements or material types not supported in the interface, notifying the user and terminating if it finds any. (See table below for correspondence between GIFTS elements and materials and their Cosmic/NASTRAN equivalents.) If the model is compatible with Cosmic/NASTRAN, GFTCOS then creates the Cosmic/NASTRAN input deck, producing two files in the process: the input file itself, named JOB.CNI, and a log file named JOB.CNL. The log file contains a record of all messages, prompts, and user responses executed while GFTCOS is running.

CORRESPONDENCE BETWEEN GIFTS AND COSMIC/NASTRAN ELEMENTS

GIFTS ELEMENT	TRANSLATED NASTRAN ELEMENT	GIFTS ANALYSIS
BEAM2	CBAR	YES
QA4	CTRAPRU	YES
QB4	CQUAD2	YES
QM4	CQDMEM1	YES
QM9	CIS2D8 (8 POINTS)	YES
ROD2	CROD	YES
SLD8	CIHEX1 (8 POINTS)	YES
SLD27	CIHEX2 (20 POINTS)	NO
SPRING	CELAS2	YES
TA3	CTRIARG	YES
TB3	CTRIA2	YES
TB6	CTRSHL	NO
TET4	CTETRA	YES
TM3	CTRMEM	YES
TM6	CTRIMG	YES
TSPRING	CELAS2	YES

CORRESPONDENCE BETWEEN GIFTS AND COSMIC/NASTRAN MATERIALS

GIFTS MATERIAL	TRANSLATED NASTRAN MATERIAL	GIFTS ANALYSIS
AALLOY	MAT1	YES
ELMAT	MAT1	YES
MSTEEL	MAT1	YES

The user can also choose to have GFTCOS create the Cosmic/NASTRAN control deck. In this case, the option of an eigen analysis is also offered, with the possibilities of using the determinant search, inverse power, givens, or modified givens method, and of normalizing the eigenvector with respect to the mass matrix, or using a selected point and freedom, or with the maximum deflection set to one.

Among the higher-order elements supported for the interface, GIFTS elements QM9 and SLD27 lack a direct counterpart in the Cosmic/NASTRAN library. Therefore, in translating GIFTS data into the Cosmic/NASTRAN input deck, GFTCOS transforms these elements into similar elements using fewer points (see element correspondence table) and notifies the user of the substitution via a message on the terminal screen. Local Cartesian, cylindrical, and spherical coordinate systems are preserved, as are prescribed displacements, loads, and temperatures. (Loads and temperatures are left untranslated when the user requests an eigen analysis.)

The Cosmic/NASTRAN input deck created by GFTCOS does not include an executive control deck; the user adds this after GFTCOS is run, by means of a text editor. At this time, the user can also edit the input deck itself, for instance by requesting output parameters in addition to the displacements handled by the interface.

The input deck is then submitted to Cosmic/NASTRAN for analysis. If GIFTS and Cosmic/NASTRAN are on different computers, of course the file must first be shipped across the link. The Cosmic/NASTRAN file produced at the end of analysis, containing displacements and stresses, must likewise be shipped back to the machine hosting GIFTS before COSGFT can be invoked.

COSGFT inserts the Cosmic/NASTRAN displacement results into the GIFTS data base. The stresses computed in Cosmic/NASTRAN are ignored, but the GIFTS post-processor STRESS can be called to recompute them for all elements fully supported in GIFTS. If the model contains other element types, such as higher-order solid and shell elements, the user can employ a special processor provided with the interface, named HOSTR, to compute approximate stress fields for them also.

The bulk of GIFTS' powerful post-processing capabilities are exercised via the post-processor RESULT. Here the user can examine all or any part of the model, labelling points, element or material types, and element sizing groups. Geometric entities and elements can be individually deleted from the plot and reactivated at will. Stress contours and vectors are available, as are shear, moment, and detailed cross-sectional plots of beams. Composite loading cases can be created and examined. A wide range of information commands allows tabular retrieval of selected subsets of data from the GIFTS data base. Color plotting permits especially clear, vivid display; and any display can be transferred to a hardcopy file. It is also possible to create animations of the analysis, for subsequent display with GIFTS post-processor VIDEO.

Example of Interface Applications

The following pages contain an example of a solid model constructed and loaded in GIFTS, analyzed in Cosmic/NASTRAN, and then examined in GIFTS. The structure is a pipe joint composed of solid elements and subjected to a combination of internal and external pressure. Printed here are the log file recording the interface procedure, the input file created from the GIFTS data base by the interface for use in Cosmic/NASTRAN, and a selection of plots from both pre- and post-processing in GIFTS. This example is only one demonstration of the way the GIFTS-Cosmic/NASTRAN interface turns GIFTS and Cosmic/NASTRAN into a single, complete general-purpose finite-element package which works on a number of computers, increasing the utility of both programs. Other interfaces are available to link GIFTS with still other programs, including many PC-based general drafting packages, thus expanding the user's capabilities still further.

```
$ SET NOVERIFY

Directory DUA1:[COSMIC]

L004.NID;1                170   5-FEB-1986 11:03

Total of 1 file, 170 blocks.
```

S O R T E D B U L K D A T A E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CIHEX1	1	1	9	10	2	1	18	20	+H1
2-	+H1	21	19							
3-	CIHEX1	2	1	18	20	21	19	37	39	+H2
4-	+H2	40	38							
5-	CIHEX1	3	1	37	39	40	38	55	57	+H3
6-	+H3	58	56							
7-	CIHEX1	4	1	55	57	58	56	73	75	+H4
8-	+H4	76	74							
9-	CIHEX1	5	1	73	75	76	74	91	93	+H5
10-	+H5	94	92							
11-	CIHEX1	6	1	91	93	94	92	109	111	+H6
12-	+H6	112	110							
13-	CIHEX1	7	1	109	111	112	110	127	129	+H7
14-	+H7	130	128							
15-	CIHEX1	8	1	127	129	130	128	145	147	+H8
16-	+H8	148	146							
17-	CIHEX1	9	1	10	11	3	2	20	22	+H9
18-	+H9	23	21							
19-	CIHEX1	10	1	20	22	23	21	39	41	+H10
20-	+H10	42	40							
21-	CIHEX1	11	1	39	41	42	40	57	59	+H11
22-	+H11	60	58							
23-	CIHEX1	12	1	57	59	60	58	75	77	+H12
24-	+H12	78	76							
25-	CIHEX1	13	1	75	77	78	76	93	95	+H13
26-	+H13	96	94							
27-	CIHEX1	14	1	93	95	96	94	111	113	+H14
28-	+H14	114	112							
29-	CIHEX1	15	1	111	113	114	112	129	131	+H15
30-	+H15	132	130							
31-	CIHEX1	16	1	129	131	132	130	147	149	+H16
32-	+H16	150	148							
33-	CIHEX1	17	1	11	12	4	3	22	24	+H17
34-	+H17	25	23							
35-	CIHEX1	18	1	22	24	25	23	41	43	+H18
36-	+H18	44	42							
37-	CIHEX1	19	1	41	43	44	42	59	61	+H19
38-	+H19	62	60							
39-	CIHEX1	20	1	59	61	62	60	77	79	+H20
40-	+H20	80	78							
41-	CIHEX1	21	1	77	79	80	78	95	97	+H21
42-	+H21	98	96							

continues .....

S O R T E D B U L K D A T A E C H O

```
CARD
COUNT      .  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  .. 10  .
1387-      GRID   578     0      -21.00000.0     4.0000000      12456
1388-      GRID   579     0      -21.0000.97545774.9039260      1456
1389-      GRID   580     0      -21.0000.78034873.9231430      1456
1390-      GRID   581     0      -21.00001.9134234.6193950      1456
1391-      GRID   582     0      -21.00001.5307223.6955230      1456
1392-      GRID   583     0      -21.00002.7778574.1573440      1456
1393-      GRID   584     0      -21.00002.2222733.3258840      1456
1394-      GRID   585     0      -21.00003.5355403.5355280      1456
1395-      GRID   586     0      -21.00002.8284242.8284300      1456
1396-      GRID   587     0      -21.00004.1573532.7778430      1456
1397-      GRID   588     0      -21.00003.3258782.2222810      1456
1398-      GRID   589     0      -21.00004.6194021.9134080      1456
1399-      GRID   590     0      -21.00003.6955191.5307300      1456
1400-      GRID   591     0      -21.00004.903929.97544340      1456
1401-      GRID   592     0      -21.00003.923142.78035640      1456
1402-      GRID   593     0      -21.00005.0000000.0     0      13456
1403-      GRID   594     0      -21.00004.0000000.0     0      13456
1404-      MAT1   1       .15000E8.60000E7.25000000.0    0.0    0.0    0.0
1405-      MAT1   2       .30000E7.12500E7.20000000.0    0.0    0.0    0.0
1406-      PIHEX  1       1
1407-      PIHEX  2       2
1408-      PIHEX  3       1
1409-      PIHEX  4       2
           ENDDATA
```

*** USER INFORMATION MESSAGES FROM RESEQUENCING PROCESSOR - BANDIT (CRI= 1, MTH= 3, MPC= 2, DEP=-1, PCH=-1)

BEFORE RESEQUENCING - - -

BANDWIDTH	54
PROFILE	18011
MAX WAVEFRONT	54
AVG WAVEFRONT	30.322
RMS WAVEFRONT	32.604

AFTER RESEQUENCING BY GIBBS-POOLE-STOCKMEYER (GPS) ALGORITHM - - -

BANDWIDTH	46
PROFILE	17407
MAX WAVEFRONT	44
AVG WAVEFRONT	29.305
RMS WAVEFRONT	30.794

*** BANDIT SUMMARY ***

	BEFORE	AFTER
BANDWIDTH (B)	54	46
PROFILE (P)	18011	17407
MAXIMUM WAVEFRONT (C-MAX)	54	44
AVERAGE WAVEFRONT (C-AVG)	30.322	29.305
RMS WAVEFRONT (C-RMS)	32.604	30.794
NUMBER OF GRID POINTS (N)		594
NUMBER OF ELEMENTS (NON-RIGID)		256
NUMBER OF RIGID ELEMENTS PROCESSED		0
NUMBER OF MPC EQUATIONS PROCESSED		0
NUMBER OF COMPONENTS		1
MAXIMUM NODAL DEGREE		17
MINIMUM NODAL DEGREE		7
NUMBER OF UNIQUE EDGES		4553
MATRIX DENSITY, PERCENT		2.749
NUMBER OF POINTS OF ZERO DEGREE		0
BANDIT OPEN CORE		249412
CRITERION		RMS WAVEFRONT
METHOD USED		GPS
NO. OF SEQGP CARDS GENERATED		149

S Y S T E M G E N E R A T E D S E Q G P C A R D S,

SEQGP	1	2	2	4	3	6	4	8
SEQGP	5	10	6	12	7	14	8	18
SEQGP	9	1	10	3	11	5	12	7
SEQGP	13	9	14	11	15	13	16	15
SEQGP	17	17	18	19	19	20	20	21
SEQGP	21	22	22	23	23	24	24	25
SEQGP	25	26	26	27	27	28	28	29
SEQGP	29	30	30	31	31	32	32	16
SEQGP	33	33	34	34	35	35	36	36
SEQGP	37	37	38	38	39	39	40	40
SEQGP	41	41	42	42	43	43	44	44
SEQGP	45	45	46	46	47	47	48	48
SEQGP	49	49	50	50	51	51	52	52
SEQGP	53	53	54	54	55	55	56	56
SEQGP	57	57	58	58	59	59	60	60
SEQGP	61	61	62	62	63	63	64	64
SEQGP	65	65	66	66	67	67	68	68
SEQGP	69	69	70	70	71	71	72	72
SEQGP	73	73	74	74	75	75	76	76
SEQGP	77	77	78	78	79	79	80	80

continues .....

SEQGP	509	174	510	173	511	168	512	167
SEQGP	513	176	514	175	515	166	516	165
SEQGP	517	178	518	177	519	164	520	163
SEQGP	521	180	522	179	523	563	524	564
SEQGP	525	565	526	566	527	567	528	568
SEQGP	529	569	530	570	531	555	532	556
SEQGP	533	537	534	538	535	515	536	516
SEQGP	537	489	538	490	539	459	540	460
SEQGP	541	577	542	578	543	579	544	580
SEQGP	545	581	546	582	547	571	548	572
SEQGP	549	557	550	558	551	539	552	540
SEQGP	553	517	554	518	555	491	556	492
SEQGP	557	461	558	462	559	587	560	588
SEQGP	561	589	562	590	563	583	564	584
SEQGP	565	573	566	574	567	559	568	560
SEQGP	569	541	570	542	571	519	572	520
SEQGP	573	493	574	494	575	463	576	464
SEQGP	577	594	578	593	579	591	580	592
SEQGP	581	585	582	586	583	575	584	576
SEQGP	585	561	586	562	587	543	588	544
SEQGP	589	521	590	522	591	495	592	496
SEQGP	593	465	594	466				

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

```
*** USER INFORMATION MESSAGE, TURN DIAG 38 ON FOR ADDITIONAL ELEMENT PROCESSING INFORMATION

*** USER FATAL MESSAGE 3302, IHEX1 ELEMENT NO.      116   ILLEGAL GEOMETRY, ALFA EXCEEDED.

*** USER FATAL MESSAGE 3302, IHEX1 ELEMENT NO.      124   ILLEGAL GEOMETRY, ALFA EXCEEDED.

*** USER FATAL MESSAGE 3302, IHEX1 ELEMENT NO.      213   ILLEGAL GEOMETRY, ALFA EXCEEDED.

*** USER FATAL MESSAGE 3302, IHEX1 ELEMENT NO.      221   ILLEGAL GEOMETRY, ALFA EXCEEDED.

*** USER FATAL MESSAGE 3302, IHEX1 ELEMENT NO.      221   ILLEGAL GEOMETRY, ALFA EXCEEDED.


***USER INFORMATION MESSAGE 3023--PARAMETERS FOR REAL   SYMMETRIC DECOMPOSITION OF DATA BLOCK KLL      ( N = 1596 )
              TIME ESTIMATE=  20586        C AVG =   81        PC AVG =    0   SPILL GROUPS =    0         S AVG =    1
            ADDITIONAL CORE=-227859        C MAX =  122        PCMAX =     0      PC GROUPS =    0  PREFACE LOOPS =    1


*** USER INFORMATION MESSAGE 3035

FOR LOAD    1 EPSILON SUB E =  1.2422739E-15
```

GIFTS LOAD CASE:1 SUBCASE 1

D I S P L A C E M E N T V E C T O R

POINT ID.	TYPE	T1	T2	T3	R1	R2	R3
1	G	0.0	0.0	-1.412810E-03	0.0	0.0	0.0
2	G	0.0	-8.293360E-05	-1.368316E-03	0.0	0.0	0.0
3	G	0.0	-1.434956E-04	-1.242397E-03	0.0	0.0	0.0
4	G	0.0	-1.666498E-04	-1.055474E-03	0.0	0.0	0.0
5	G	0.0	-1.495623E-04	-8.347788E-04	0.0	0.0	0.0
6	G	0.0	-1.023543E-04	-6.065379E-04	0.0	0.0	0.0
7	G	0.0	-4.450929E-05	-3.889870E-04	0.0	0.0	0.0
8	G	0.0	1.944273E-05	0.0	0.0	0.0	0.0
9	G	0.0	0.0	-1.379316E-03	0.0	0.0	0.0
10	G	0.0	-1.610228E-04	-1.318456E-03	0.0	0.0	0.0
11	G	0.0	-2.777156E-04	-1.149825E-03	0.0	0.0	0.0
12	G	0.0	-3.203591E-04	-9.107926E-04	0.0	0.0	0.0
13	G	0.0	-2.834938E-04	-6.502475E-04	0.0	0.0	0.0
14	G	0.0	-1.873774E-04	-4.133017E-04	0.0	0.0	0.0
15	G	0.0	-7.080255E-05	-2.277407E-04	0.0	0.0	0.0
16	G	0.0	2.224120E-05	-9.671461E-05	0.0	0.0	0.0
17	G	0.0	5.753958E-05	0.0	0.0	0.0	0.0
18	G	-6.841561E-05	0.0	-1.386334E-03	0.0	0.0	0.0
19	G	-5.449258E-05	0.0	-1.420199E-03	0.0	0.0	0.0
20	G	-6.868053E-05	-1.617761E-04	-1.325242E-03	0.0	0.0	0.0
21	G	-5.521253E-05	-8.346338E-05	-1.375516E-03	0.0	0.0	0.0
22	G	-6.941930E-05	-2.790896E-04	-1.155956E-03	0.0	0.0	0.0
23	G	-5.725115E-05	-1.444824E-04	-1.249049E-03	0.0	0.0	0.0
24	G	-7.048190E-05	-3.221241E-04	-9.159508E-04	0.0	0.0	0.0
25	G	-6.026979E-05	-1.679666E-04	-1.061282E-03	0.0	0.0	0.0
26	G	-7.166900E-05	-2.853871E-04	-6.542657E-04	0.0	0.0	0.0
27	G	-6.378039E-05	-1.510606E-04	-8.395361E-04	0.0	0.0	0.0
28	G	-7.278436E-05	-1.891781E-04	-4.161623E-04	0.0	0.0	0.0
29	G	-6.723651E-05	-1.039039E-04	-6.101293E-04	0.0	0.0	0.0
30	G	-7.367384E-05	-7.239363E-05	-2.295345E-04	0.0	0.0	0.0
31	G	-7.012354E-05	-4.602856E-05	-3.913739E-04	0.0	0.0	0.0
32	G	0.0	1.835273E-06	-1.884948E-04	0.0	0.0	0.0
33	G	-7.423946E-05	2.084744E-05	-9.756794E-05	0.0	0.0	0.0
34	G	-7.203059E-05	3.674250E-07	-1.896816E-04	0.0	0.0	0.0
35	G	-7.443262E-05	5.622514E-05	0.0	0.0	0.0	0.0
36	G	-7.269604E-05	1.799822E-05	0.0	0.0	0.0	0.0
37	G	-1.333498E-04	0.0	-1.405247E-03	0.0	0.0	0.0
38	G	-1.112928E-04	0.0	-1.440140E-03	0.0	0.0	0.0
39	G	-1.339938E-04	-1.636622E-04	-1.343518E-03	0.0	0.0	0.0
40	G	-1.127926E-04	-8.469930E-05	-1.394937E-03	0.0	0.0	0.0
41	G	-1.357890E-04	-2.824959E-04	-1.172427E-03	0.0	0.0	0.0
42	G	-1.170397E-04	-1.467525E-04	-1.266974E-03	0.0	0.0	0.0

continues .....

589	G	0.0	-1.015947E-03	2.145764E-04	0.0	0.0	0.0
590	G	0.0	-1.181167E-03	6.788397E-04	0.0	0.0	0.0
591	G	0.0	-1.383135E-03	4.928993E-05	0.0	0.0	0.0
592	G	0.0	-1.412404E-03	3.188860E-04	0.0	0.0	0.0
593	G	0.0	-1.520760E-03	0.0	0.0	0.0	0.0
594	G	0.0	-1.496575E-03	0.0	0.0	0.0	0.0

*** SYSTEM WARNING MESSAGE 3022

DATA BLOCK PLTPAR IS REQUIRED AS INPUT AND IS NOT OUTPUT BY A PREVIOUS MODULE IN THE CURRENT DMAP ROUTE.

*** SYSTEM WARNING MESSAGE 3022

DATA BLOCK GPSETS IS REQUIRED AS INPUT AND IS NOT OUTPUT BY A PREVIOUS MODULE IN THE CURRENT DMAP ROUTE.

*** SYSTEM WARNING MESSAGE 3022

DATA BLOCK ELSETS IS REQUIRED AS INPUT AND IS NOT OUTPUT BY A PREVIOUS MODULE IN THE CURRENT DMAP ROUTE.

* * * END OF JOB * * *

```
11:06:34          0.0 ELAPSED SECONDS       0.0 CPU SECONDS      SEM1  BEGN
11:06:40          6.0 ELAPSED SECONDS       3.0 CPU SECONDS      GNFI
11:06:41          7.0 ELAPSED SECONDS       3.0 CPU SECONDS      TTIO
11:08:01         87.0 ELAPSED SECONDS      74.0 CPU SECONDS      TTLP
11:09:23        169.0 ELAPSED SECONDS     155.0 CPU SECONDS      XCSA
11:09:39        185.0 ELAPSED SECONDS     168.0 CPU SECONDS      IFP1
11:09:43        189.0 ELAPSED SECONDS     171.0 CPU SECONDS      XSOR
11:12:12        338.0 ELAPSED SECONDS     305.0 CPU SECONDS      IFP   BEGN
11:14:02        448.0 ELAPSED SECONDS     407.0 CPU SECONDS      IFP   END
11:14:02        448.0 ELAPSED SECONDS     407.0 CPU SECONDS      XGPI
11:14:21        467.0 ELAPSED SECONDS     425.0 CPU SECONDS      BAND  IT  BEGN11:15:34        541.0 ELAPSED SECONDS     478.0 CPU
 SECONDS      BAND
  END
11:15:36        542.0 ELAPSED SECONDS     478.0 CPU SECONDS      SEM1  END
11:15:42        548.0 ELAPSED SECONDS     480.0 CPU SECONDS      LINK   1        END
11:15:42        548.0 ELAPSED SECONDS     480.0 CPU SECONDS      ----  --------  ----
11:15:55        561.0 ELAPSED SECONDS     485.0 CPU SECONDS      LINK   2        BEGN
11:15:55        561.0 ELAPSED SECONDS     486.0 CPU SECONDS         5  PARAM     BEGN
11:15:55        561.0 ELAPSED SECONDS     486.0 CPU SECONDS         5  PARAM     END
11:15:55        561.0 ELAPSED SECONDS     486.0 CPU SECONDS      XSFA      BEGN11:15:58        564.0 ELAPSED SECONDS     487.0 CPU
 SECONDS      XSFA
  END
11:15:59        565.0 ELAPSED SECONDS     487.0 CPU SECONDS         6  GP1       BEGN
11:17:01        628.0 ELAPSED SECONDS     536.0 CPU SECONDS         6  GP1       END
11:17:02        628.0 ELAPSED SECONDS     536.0 CPU SECONDS         7  PLTTRAN   BEGN
11:17:09        635.0 ELAPSED SECONDS     541.0 CPU SECONDS         7  PLTTRAN   END
11:17:09        635.0 ELAPSED SECONDS     541.0 CPU SECONDS         8  GP2       BEGN
11:17:14        640.0 ELAPSED SECONDS     544.0 CPU SECONDS         8  GP2       END
11:17:14        640.0 ELAPSED SECONDS     544.0 CPU SECONDS         9  PARAML    BEGN
11:17:14        640.0 ELAPSED SECONDS     544.0 CPU SECONDS         9  PARAML    END

 continues ........
20:16:09      32975.0 ELAPSED SECONDS   32388.0 CPU SECONDS           XSFA      BEGN
20:16:11      32977.0 ELAPSED SECONDS   32389.0 CPU SECONDS           XSFA       END
20:16:11      32977.0 ELAPSED SECONDS   32389.0 CPU SECONDS       140 SCAN      BEGN
20:16:11      32977.0 ELAPSED SECONDS   32389.0 CPU SECONDS       140 SCAN      END
20:16:12      32978.0 ELAPSED SECONDS   32389.0 CPU SECONDS       141 OFP       BEGN
20:16:12      32978.0 ELAPSED SECONDS   32389.0 CPU SECONDS       141 OFP       END
20:16:12      32978.0 ELAPSED SECONDS   32389.0 CPU SECONDS       142 OFP       BEGN
20:16:12      32978.0 ELAPSED SECONDS   32389.0 CPU SECONDS       142 OFP       END
20:16:12      32978.0 ELAPSED SECONDS   32389.0 CPU SECONDS       144 COND      BEGN
20:16:12      32978.0 ELAPSED SECONDS   32390.0 CPU SECONDS       144 COND      END
20:16:13      32979.0 ELAPSED SECONDS   32390.0 CPU SECONDS       149 COND      BEGN
20:16:13      32979.0 ELAPSED SECONDS   32390.0 CPU SECONDS       149 COND      END
20:16:13      32979.0 ELAPSED SECONDS   32390.0 CPU SECONDS       163 PURGE     BEGN
20:16:13      32979.0 ELAPSED SECONDS   32390.0 CPU SECONDS       163 PURGE     END
20:16:13      32979.0 ELAPSED SECONDS   32390.0 CPU SECONDS       164 EXIT      BEGN

Directory DUA1:[COSMIC]

Total of 50 files, 4444/4509 blocks.
  COSMIC       job terminated at  5-FEB-1986 20:16:39.84

  Accounting information:
  Buffered I/O count:          1757      Peak working set size:   512
  Direct I/O count:            6838      Peak page file size:    3253
  Page faults:                28863      Mounted volumes:           0
  Charged CPU time:     0 09:00:11.17    Elapsed time:     0 09:10:20.79
```

Input File For Use in Cosmic/NASTRAN

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TITLE = GIFTS MODEL:L004
OUTPUT
   DISP = ALL
SUBCASE 1
   LABEL = GIFTS LOAD CASE:1
   LOAD = 1
BEGIN BULK
GRID     1       0       0.      0.      4.0000000       12456
GRID     2       0       0.      .78034873.9231430       1456
GRID     3       0       0.      1.5307223.6955230       1456
GRID     4       0       0.      2.2222733.3258840       1456
GRID     5       0       0.      2.8284242.8284300       1456
GRID     6       0       0.      3.3258782.2222810       1456
GRID     7       0       0.      3.6955191.5307300       1456
GRID     8       0       0.      4.0000000.      0       13456
GRID     9       0       0.      0.      5.0000000       12456
GRID     10      0       0.      .97545774.9039260       1456
GRID     11      0       0.      1.9134234.6193950       1456
GRID     12      0       0.      2.7778574.1573440       1456
GRID     13      0       0.      3.5355403.5355280       1456
GRID     14      0       0.      4.1573532.7778430       1456
GRID     15      0       0.      4.6194021.9134080       1456
GRID     16      0       0.      4.903929.97544340       1456
GRID     17      0       0.      5.0000000.      0       13456
GRID     18      0       -.8750000.      5.0000000       2456
GRID     19      0       -.8750000.      4.0000000       2456
GRID     20      0       -.875000.97545774.9039260       456
GRID     21      0       -.875000.78034403.9231440       456
GRID     22      0       -.8750001.9134234.6193950       456
GRID     23      0       -.8750001.5307173.6955250       456
GRID     24      0       -.8750002.7778574.1573440       456
GRID     25      0       -.8750002.2222713.3258860       456
continues .......
GRID     555     0       -19.01664.907369.95798270       456
GRID     556     0       -18.61203.930016.74496690       456
GRID     557     0       -19.00005.0000000.      0       3456
GRID     558     0       -18.50004.0000000.      0       3456
GRID     559     0       -20.12500.      5.0000000       2456
GRID     560     0       -20.12500.      4.0000000       2456
GRID     561     0       -20.1059.96650064.9057000       456
GRID     562     0       -20.0922.76348823.9264590       456
GRID     563     0       -20.08661.9035634.6234680       456
GRID     564     0       -20.05551.5103103.7039130       456
GRID     565     0       -20.06772.7721614.1611440       456
GRID     566     0       -20.01422.2085223.3350320       456
GRID     567     0       -20.04983.5353783.5356900       456
GRID     568     0       -19.96802.8255032.8313470       456
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GRID     574     0       -19.80603.926577.76288970       456
GRID     575     0       -20.00005.0000000.      0       3456
GRID     576     0       -19.75004.0000000.      0       3456
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GRID     578     0       -21.00000.      4.0000000       12456
GRID     579     0       -21.0000.97545774.9039260       1456
GRID     580     0       -21.0000.78034873.9231430       1456
GRID     581     0       -21.00001.9134234.6193950       1456
GRID     582     0       -21.00001.5307223.6955230       1456
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GRID    583     0       -21.00002.7778574.1573440       1456
GRID    584     0       -21.00002.2222733.3258840       1456
GRID    585     0       -21.00003.5355403 5355280       1456
GRID    586     0       -21.00002.8284242.8284300       1456
GRID    587     0       -21.00004.1573532.7778430       1456
GRID    588     0       -21.00003.3258782.2222810       1456
GRID    589     0       -21.00004.6194021.9134080       1456
GRID    590     0       -21.00003.6955191.5307300       1456
GRID    591     0       -21.00004.903929.97544340       1456
GRID    592     0       -21.00003.923142.78035640       1456
GRID    593     0       -21.00005.0000000.      0       13456
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MAT1    2       .30000E7.12500E7.20000000.      0.      0.      0.
PIHEX   1       1
CIHEX1  1       1       9       10      2       1       18      20      +H1
+H1     21      19
CIHEX1  2       1       18      20      21      19      37      39      +H2
+H2     40      38
CIHEX1  3       1       37      39      40      38      55      57      +H3
+H3     58      56
CIHEX1  4       1       55      57      58      56      73      75      +H4
+H4     76      74
CIHEX1  5       1       73      75      76      74      91      93      +H5
+H5     94      92
CIHEX1  6       1       91      93      94      92      109     111     +H6
+H6     112     110
CIHEX1  7       1       109     111     112     110     127     129     +H7
+H7     130     128
CIHEX1  8       1       127     129     130     128     145     147     +H8
+H8     148     146
CIHEX1  9       1       10      11      3       2       20      22      +H9
+H9     23      21
CIHEX1  10      1       20      22      23      21      39      41      +H10
+H10    42      40
CIHEX1  11      1       39      41      42      40      57      59      +H11
+H11    60      58
CIHEX1  12      1       57      59      60      58      75      77      +H12
+H12    78      76
CIHEX1  13      1       75      77      78      76      93      95      +H13
+H13    96      94
CIHEX1  14      1       93      95      96      94      111     113     +H14
+H14    114     112
CIHEX1  15      1       111     113     114     112     129     131     +H15
+H15    132     130
CIHEX1  16      1       129     131     132     130     147     149     +H16
+H16    150     148
CIHEX1  17      1       11      12      4       3       22      24      +H17
+H17    25      23
CIHEX1  18      1       22      24      25      23      41      43      +H18
+H18    44      42
CIHEX1  19      1       41      43      44      42      59      61      +H19
+H19    62      60
CIHEX1  20      1       59      61      62      60      77      79      +H20
+H20    80      78
CIHEX1  21      1       77      79      80      78      95      97      +H21
+H21    98      96
CIHEX1  22      1       95      97      98      96      113     115     +H22
+H22    116     114
CIHEX1  23      1       113     115     116     114     131     133     +H23
+H23    134     132
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CIHEX1  24      1       131     133     134     132     149     151     +H24
+H24    152     150
CIHEX1  25      1       12      13      5       4       24      26      +H25
+H25    27      25
CIHEX1  26      1       24      26      27      25      43      45      +H26
+H26    46      44
CIHEX1  27      1       43      45      46      44      61      63      +H27
+H27    64      62
 continued .......
CIHEX1  224     3       297     299     300     298     327     329     +H224
+H224   330     328
PIHEX   4       2
CIHEX1  225     4       489     490     492     491     443     444     +H225
+H225   446     445
CIHEX1  226     4       491     492     494     493     445     446     +H226
+H226   448     447
CIHEX1  227     4       493     494     496     495     447     448     +H227
+H227   450     449
CIHEX1  228     4       495     496     498     497     449     450     +H228
+H228   452     451
CIHEX1  229     4       497     498     500     499     451     452     +H229
+H229   454     453
CIHEX1  230     4       499     500     502     501     453     454     +H230
+H230   456     455
CIHEX1  231     4       501     502     504     503     455     456     +H231
+H231   470     469
CIHEX1  232     4       503     504     522     521     469     470     +H232
+H232   518     517
CIHEX1  233     4       443     444     446     445     401     402     +H233
+H233   404     403
CIHEX1  234     4       445     446     448     447     403     404     +H234
+H234   406     405
CIHEX1  235     4       447     448     450     449     405     406     +H235
+H235   408     407
CIHEX1  236     4       449     450     452     451     407     408     +H236
+H236   410     409
CIHEX1  237     4       451     452     454     453     409     410     +H237
+H237   412     411
CIHEX1  238     4       453     454     456     455     411     412     +H238
+H238   422     421
CIHEX1  239     4       455     456     470     469     421     422     +H239
+H239   466     465
CIHEX1  240     4       469     470     518     517     465     466     +H240
+H240   514     513
CIHEX1  241     4       401     402     404     403     363     364     +H241
+H241   366     365
CIHEX1  242     4       403     404     406     405     365     366     +H242
+H242   368     367
CIHEX1  243     4       405     406     408     407     367     368     +H243
+H243   370     369
CIHEX1  244     4       407     408     410     409     369     370     +H244
+H244   372     371
CIHEX1  245     4       409     410     412     411     371     372     +H245
+H245   378     377
CIHEX1  246     4       411     412     422     421     377     378     +H246
+H246   418     417
CIHEX1  247     4       421     422     466     465     417     418     +H247
+H247   462     461
CIHEX1  248     4       465     466     514     513     461     462     +H248
+H248   510     509
CIHEX1  249     4       363     364     366     365     329     330     +H249
+H249   332     331
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CIHEX1  250     4       365     366     368     367     331     332     +H250
+H250   334     333
CIHEX1  251     4       367     368     370     369     333     334     +H251
+H251   336     335
CIHEX1  252     4       369     370     372     371     335     336     +H252
+H252   338     337
CIHEX1  253     4       371     372     378     377     337     338     +H253
+H253   374     373
CIHEX1  254     4       377     378     418     417     373     374     +H254
+H254   414     413
CIHEX1  255     4       417     418     462     461     413     414     +H255
+H255   458     457
CIHEX1  256     4       461     462     510     509     457     458     +H256
+H256   506     505
FORCE   1       1       0       85.76326-.557E-6-.098016-.995185
FORCE   1       2       0       170.7023-.533E-6-.195089-.980786
FORCE   1       3       0       170.7047-.73E-6 -.382681-.923881
FORCE   1       4       0       170.7053-.263E-7-.555568-.831471
FORCE   1       5       0       170.7053.5430E-6-.707106-.707107
FORCE   1       6       0       170.7052.4778E-6-.831470-.555570
FORCE   1       7       0       170.7045.8475E-6-.923880-.382683
FORCE   1       8       0       85.764160.      -.995185-.098016
FORCE   1       19      0       171.5260-.564E-6-.098016-.995185
FORCE   1       21      0       341.4041-.457E-6-.195089-.980786
FORCE   1       23      0       341.4094-.365E-6-.382680-.923881
FORCE   1       25      0       341.4116-.154E-6-.555568-.831471
FORCE   1       27      0       341.4119.3313E-6-.707106-.707107
FORCE   1       29      0       341.4111.6515E-6-.831470-.555570
FORCE   1       31      0       341.4094.8723E-6-.923880-.382683
FORCE   1       32      0       170.7033.4893E-6-.980785-.195090
FORCE   1       34      0       341.4060.5142E-6-.980785-.195090
FORCE   1       36      0       171.52750.      -.995185-.098016
FORCE   1       38      0       171.5251-.567E-6-.098015-.995185
FORCE   1       40      0       341.4031-.721E-6-.195088-.980786
FORCE   1       42      0       341.4097-.386E-6-.382679-.923882
FORCE   1       44      0       341.4128-.857E-7-.555568-.831471
FORCE   1       46      0       341.4136.1576E-6-.707107-.707107
FORCE   1       48      0       341.4121.7806E-6-.831470-.555569
FORCE   1       50      0       341.4097.7543E-6-.923881-.382681
FORCE   1       52      0       341.4043.2671E-6-.980785-.195089
FORCE   1       54      0       171.52600.      -.995185-.098015
FORCE   1       56      0       171.5242-.551E-6-.098014-.995185
FORCE   1       58      0       341.4021-.712E-6-.195087-.980786
FORCE   1       60      0       341.4099-.756E-6-.382679-.923882
FORCE   1       62      0       341.4141-.79E-7 -.555567-.831472
FORCE   1       64      0       341.4153.3313E-6-.707107-.707107
FORCE   1       66      0       341.4136.5689E-6-.831471-.555568
FORCE   1       68      0       341.4099.7344E-6-.923881-.382680
FORCE   1       70      0       341.4026.2472E-6-.980786-.195088
FORCE   1       72      0       171.52470.      -.995185-.098014
FORCE   1       74      0       171.5232-.551E-6-.098014-.995185
FORCE   1       76      0       341.4004-.45E-6 -.195086-.980786
FORCE   1       78      0       341.4102-.365E-6-.382677-.923882
FORCE   1       80      0       341.4153-.154E-6-.555567-.831472
FORCE   1       82      0       341.4172.3313E-6-.707107-.707107
FORCE   1       84      0       341.4153.6515E-6-.831472-.555567
FORCE   1       86      0       341.4099.8673E-6-.923882-.382679
FORCE   1       88      0       341.4009.5092E-6-.980786-.195087
FORCE   1       90      0       171.52350.      -.995185-.098013
FORCE   1       92      0       171.5222-.561E-6-.098013-.995185
FORCE   1       94      0       341.3994-.455E-6-.195086-.980786
FORCE   1       96      0       341.4104-.124E-6-.382677-.923882
FORCE   1       98      0       341.4165-.858E-7-.555566-.831472
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FORCE    1        528      0        370.4331.0021883.3695893.9291924
FORCE    1        530      0        399.7581.0022033.5467626.8372850
FORCE    1        532      0        424.6436.0011886.7063760.7078357
FORCE    1        534      0        441.6260-.319E-3.8368124.5474901
FORCE    1        536      0        448.7356-.001508.9298403.3679607
FORCE    1        538      0        446.4216-.001699.9830975.1830739
FORCE    1        540      0        222.4615-.001473.9959748.0896217
FORCE    1        542      0        167.17090.       .0926010.9957032
FORCE    1        544      0        345.1616.9513E-3.1894745.9818855
FORCE    1        546      0        370.0320.0021255.3739749.9274365
FORCE    1        548      0        394.7087.0020921.5499132.8352189
FORCE    1        550      0        417.1165.0011103.7070861.7071265
FORCE    1        552      0        435.1235-.32E-3 .8356379.5492803
FORCE    1        554      0        447.2412-.001432.9283869.3716130
FORCE    1        556      0        453.1758-.001653.9825720.1858730
FORCE    1        558      0        228.2964-.001469.9957484.0921032
FORCE    1        560      0        170.98220.       .0948008.9954963
FORCE    1        562      0        349.9470.9346E-3.1923786.9813204
FORCE    1        564      0        369.5327.0020654.3781974.9257224
FORCE    1        566      0        389.8376.0019884.5529263.8332276
FORCE    1        568      0        409.9722.0010391.7077617.7064510
FORCE    1        570      0        428.8962-.286E-3.8345078.5509961
FORCE    1        572      0        445.6563-.001361.9269736.3751231
FORCE    1        574      0        459.6250-.001610.9820634.1885440
FORCE    1        576      0        233.9797-.001465.9955221.0945179
FORCE    1        578      0        86.434690.       .0958782.9953930
FORCE    1        580      0        176.1477.9262E-3.1937943.9810417
FORCE    1        582      0        184.6307.0020354.3802702.9248732
FORCE    1        584      0        193.7235.0019373.5544077.8322430
FORCE    1        586      0        203.2462.0010048.7080938.7061177
FORCE    1        588      0        212.9244-.277E-3.8339486.5518419
FORCE    1        590      0        222.4211-.001327.9262747.3768466
FORCE    1        592      0        231.3876-.001590.9818138.1898394
FORCE    1        594      0        118.3921-.001463.9954097.0956946
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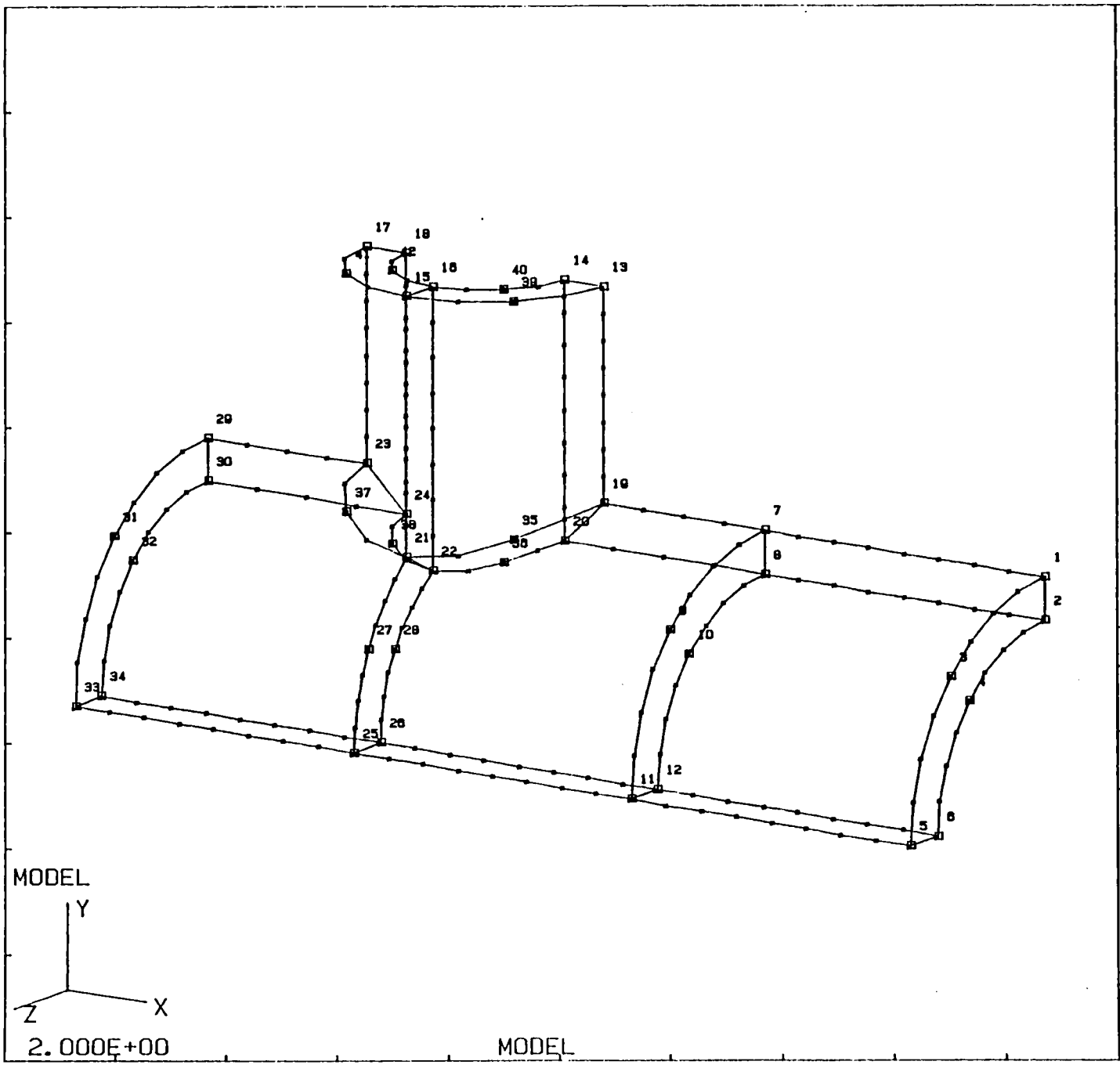
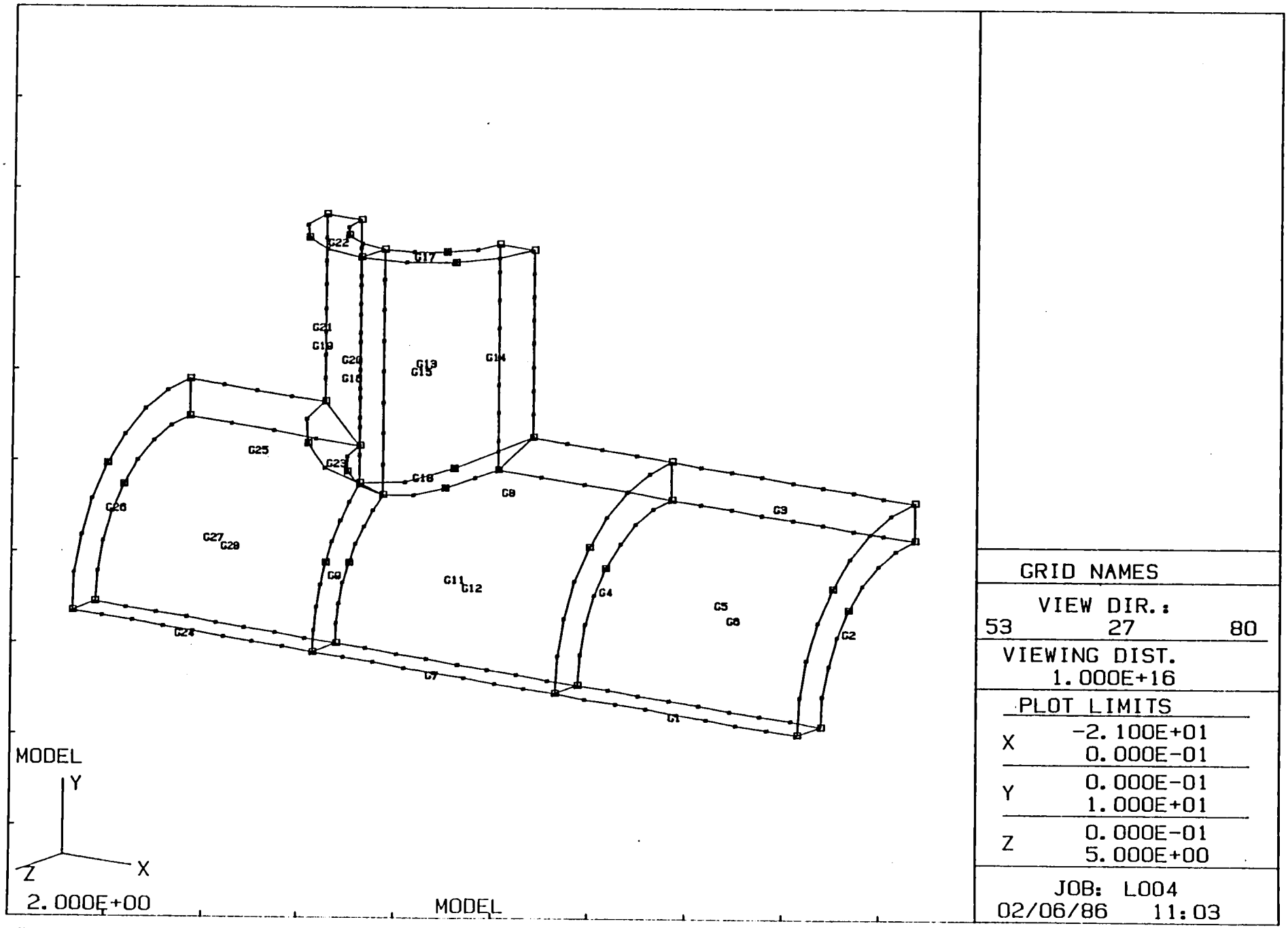
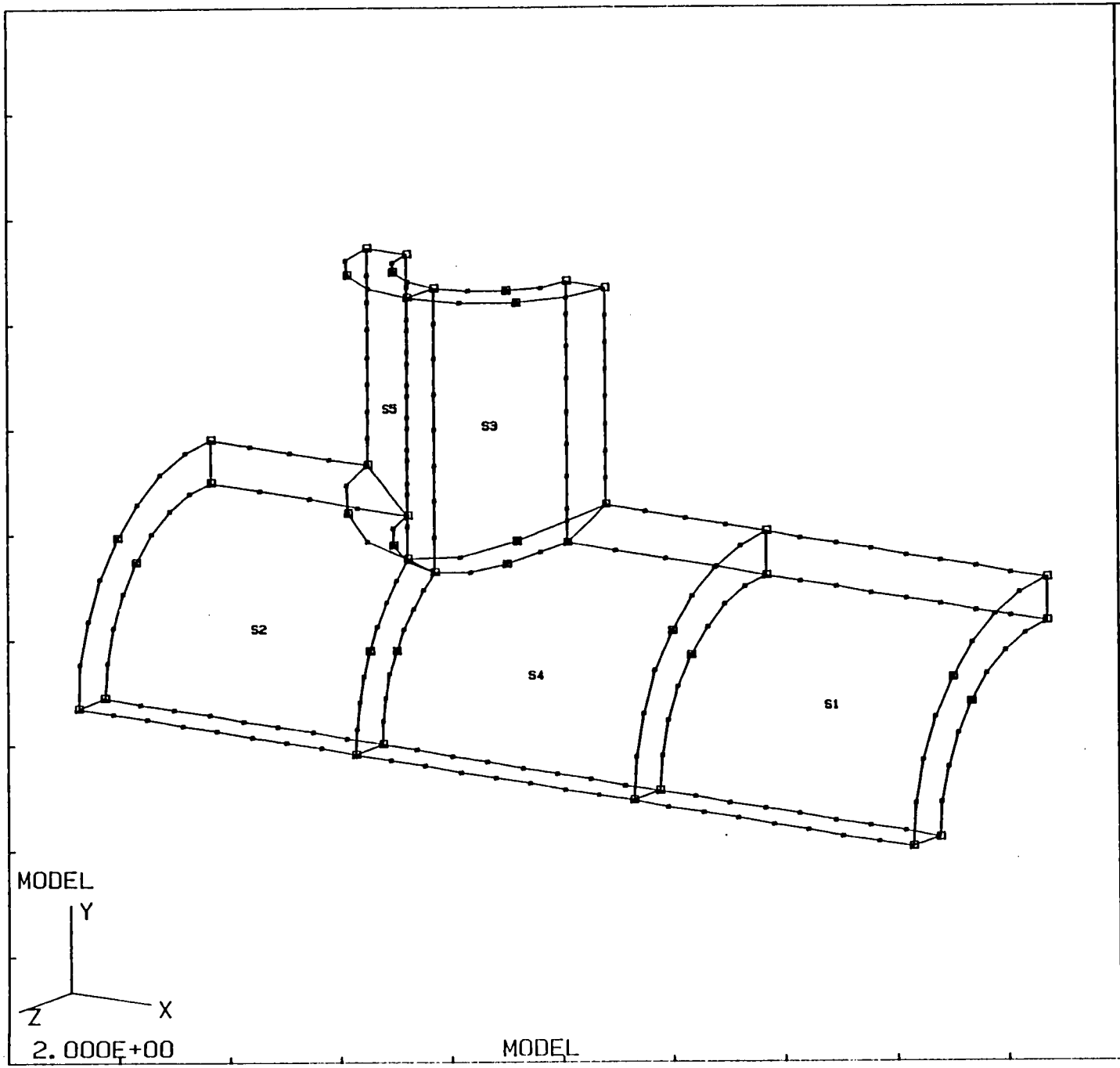


Pre-Processing: Key Points



Pre-Processing: Grid Names



SOLID NAMES

VIEW DIR.:
53 27 80

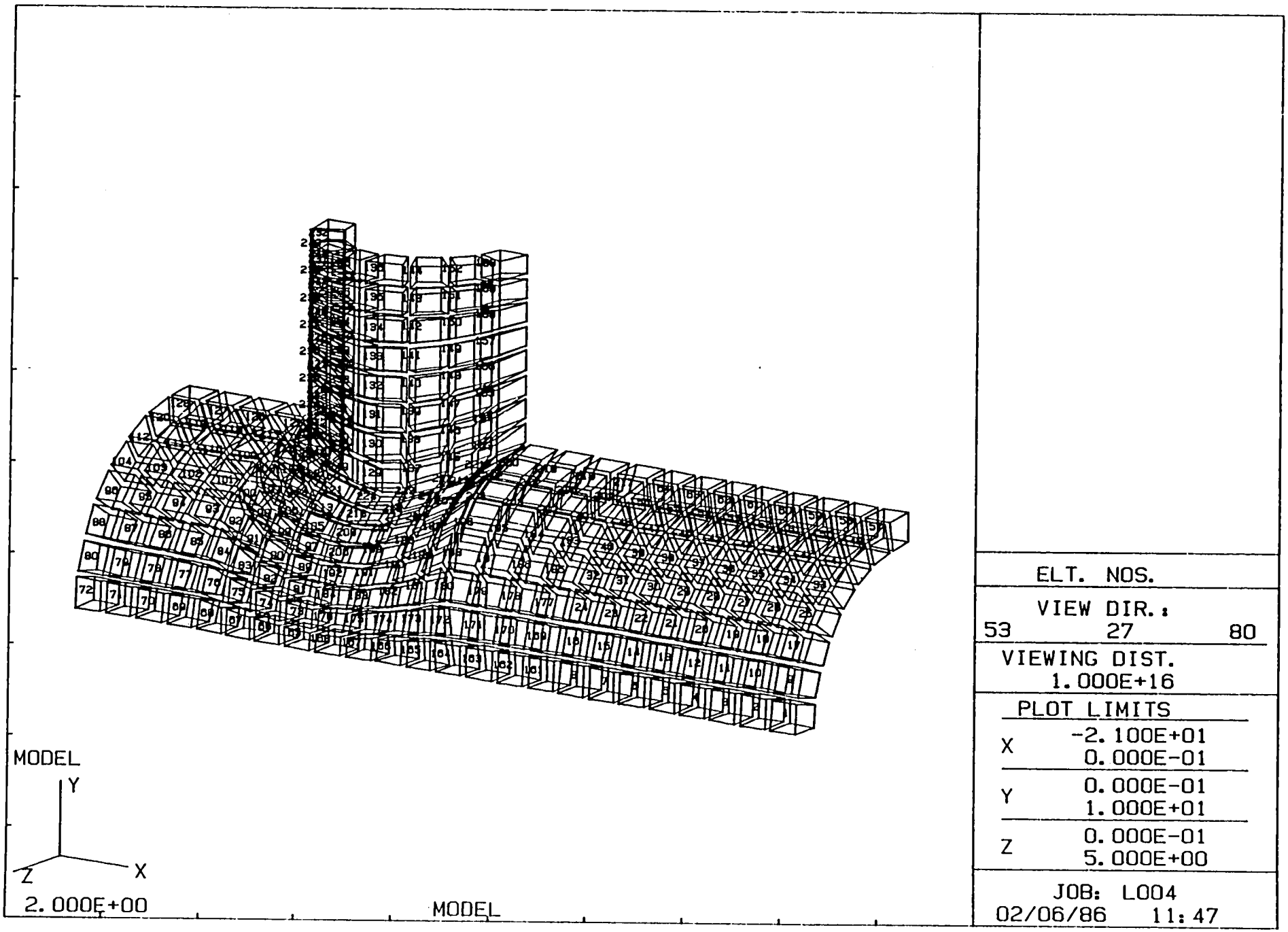
VIEWING DIST.
1.000E+16

PLOT LIMITS

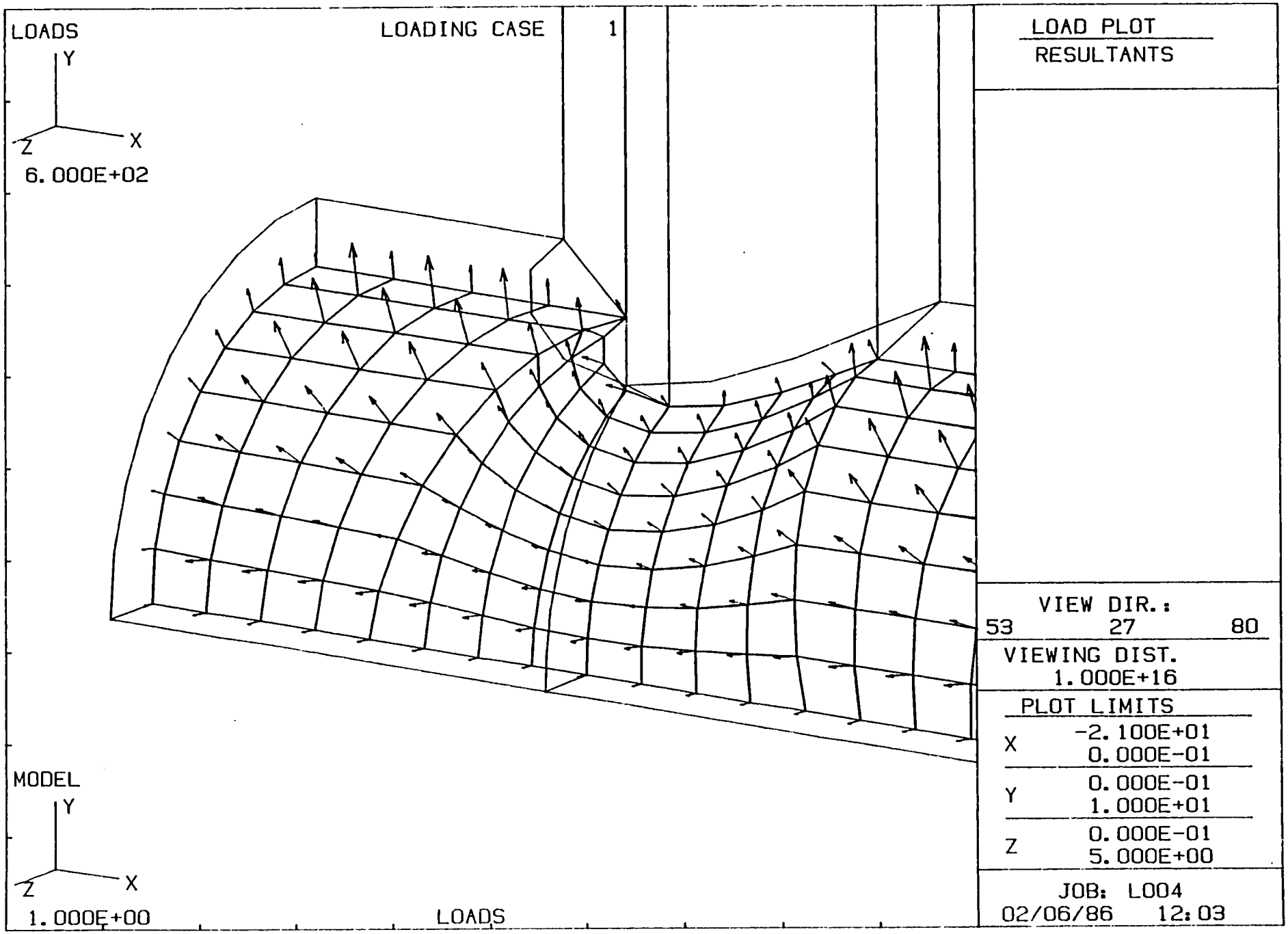
X	-2.100E+01 0.000E-01
Y	0.000E-01 1.000E+01
Z	0.000E-01 5.000E+00

JOB: L004
02/06/86 11:03

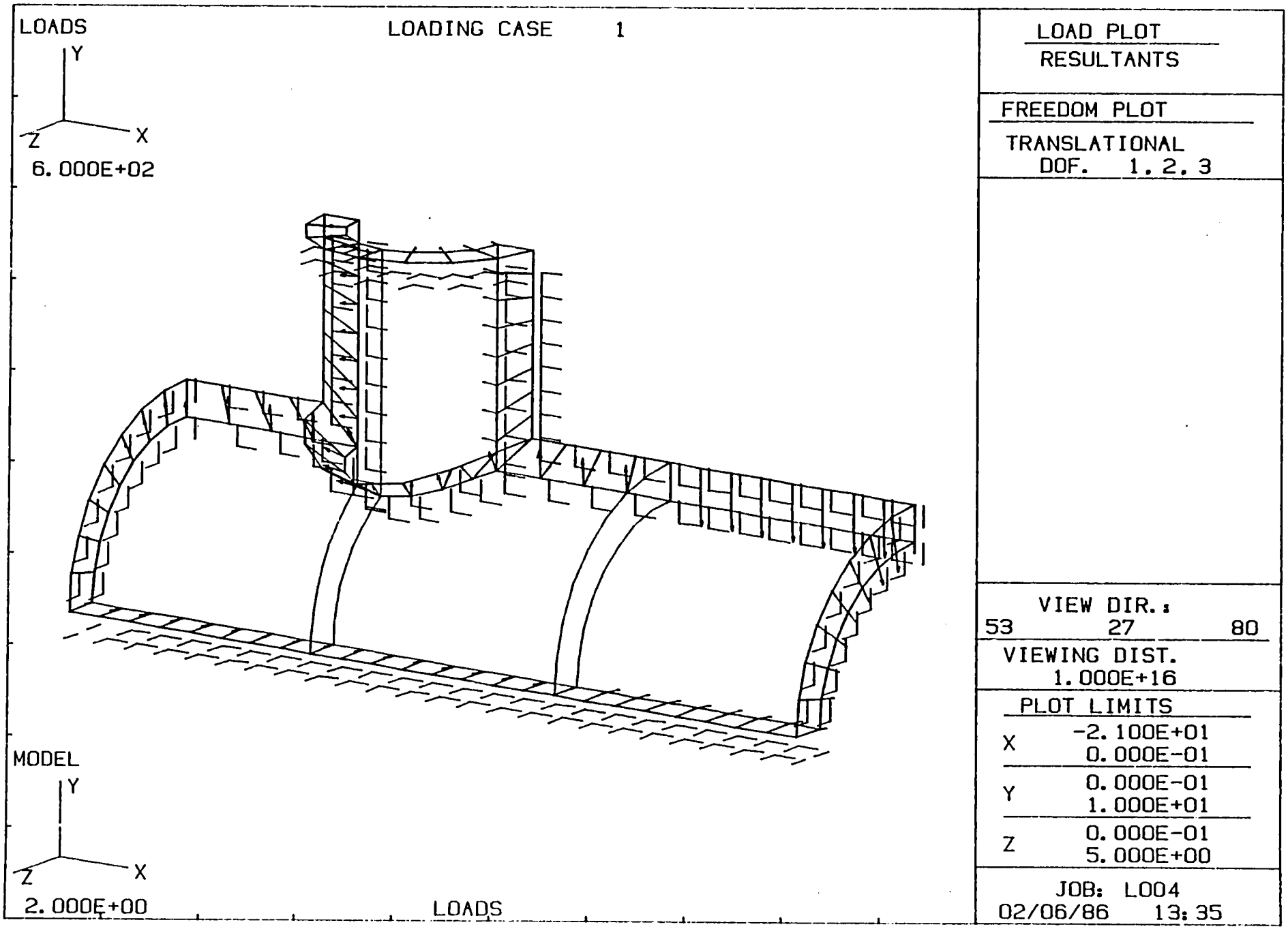
Pre-Processing: Solid Names



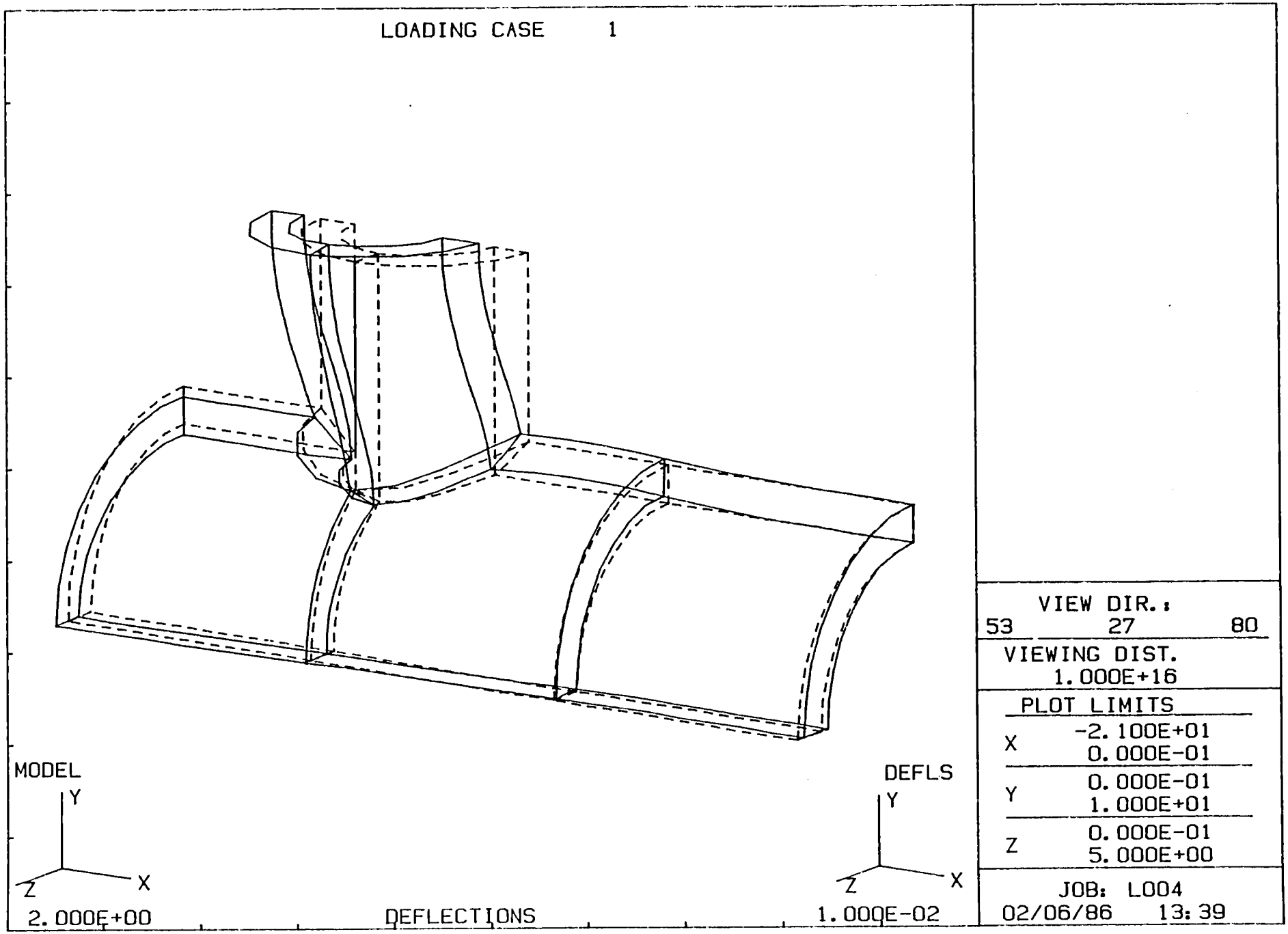
Pre-Processing: Element Slice With Element Numbers (Elements Shrunken 20% For Display)



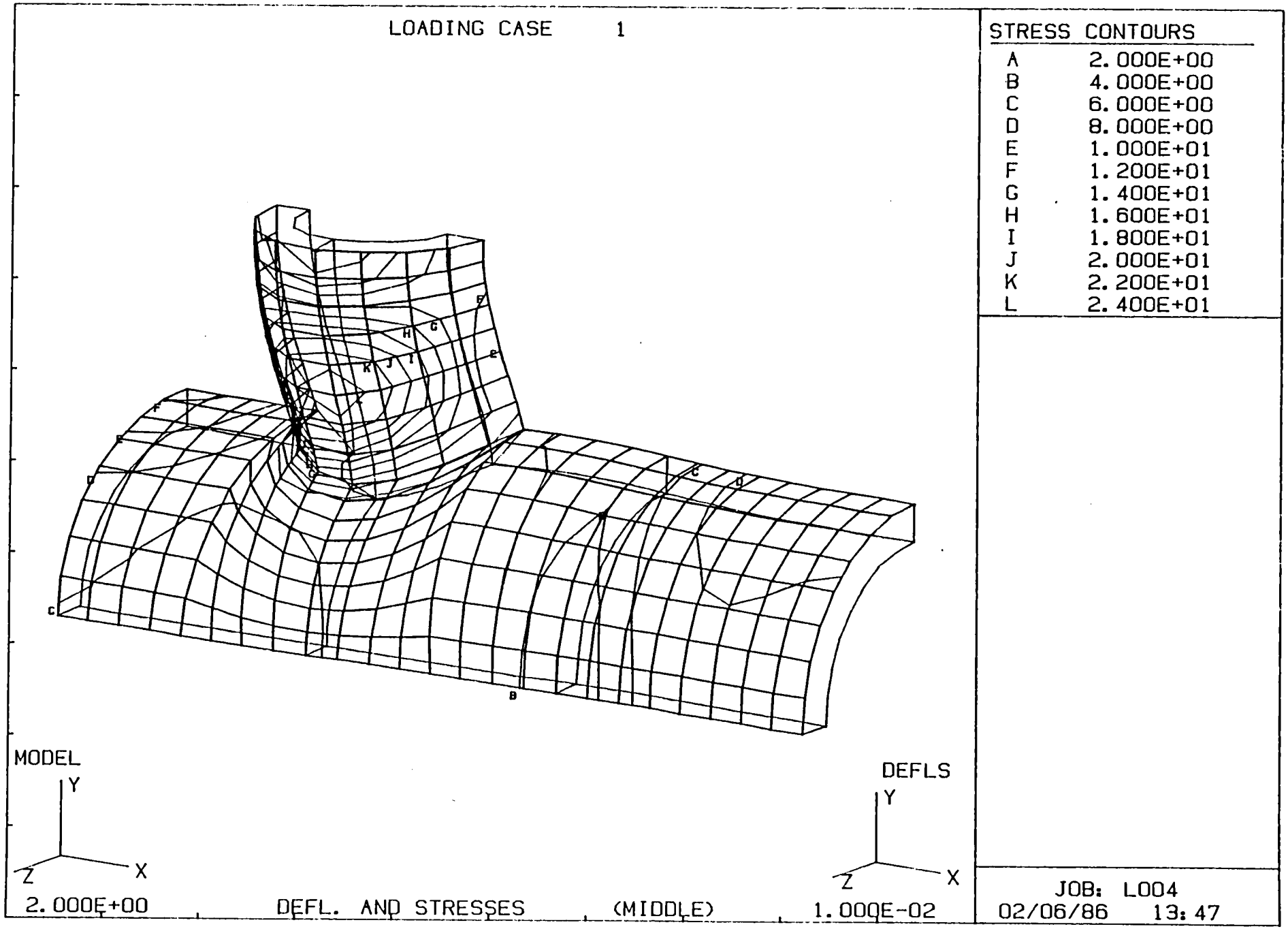
Pre-Processing: Window on Selected Load Vectors



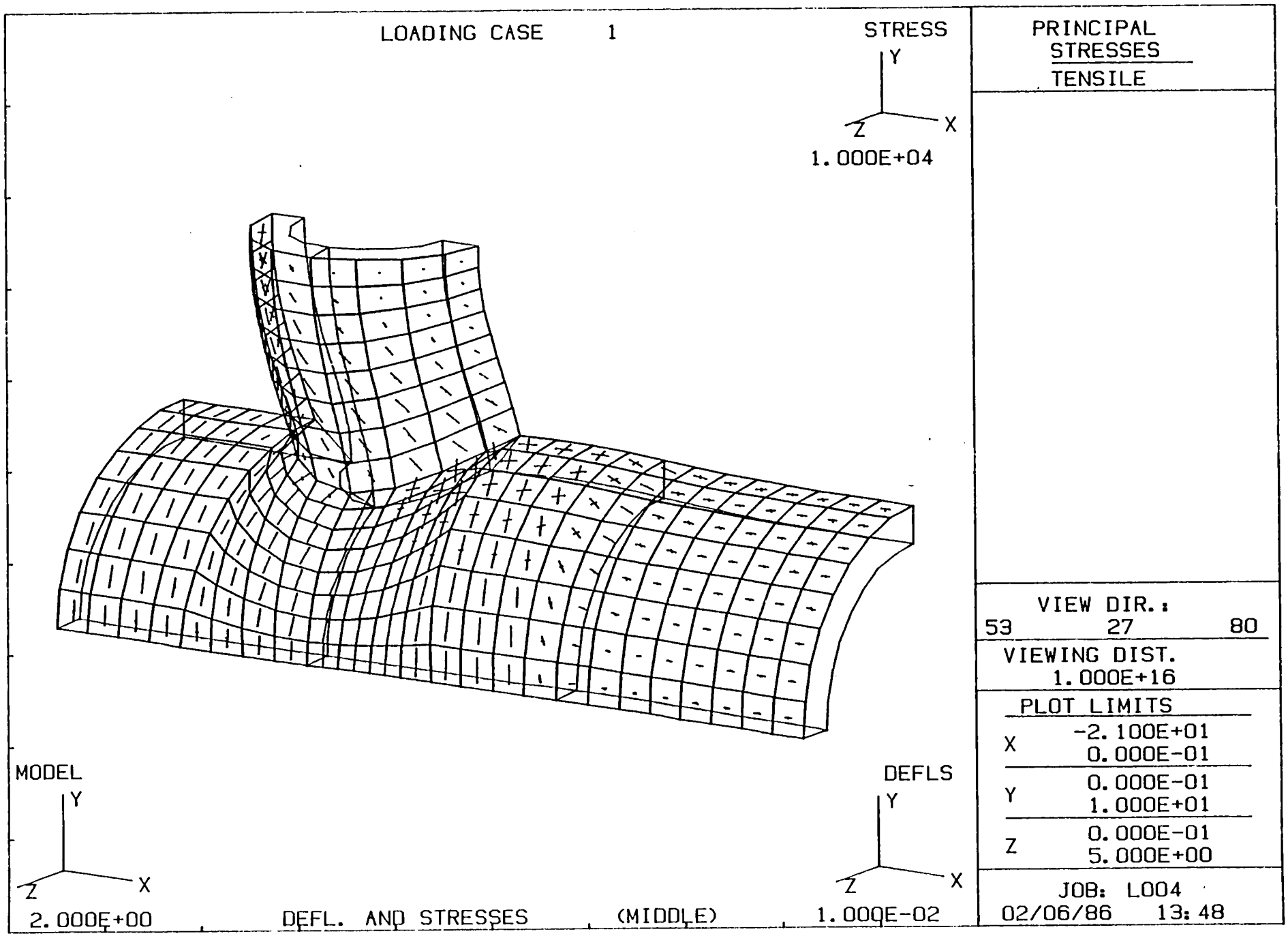
Pre-Processing: Translational Freedoms and Selected Load Vectors



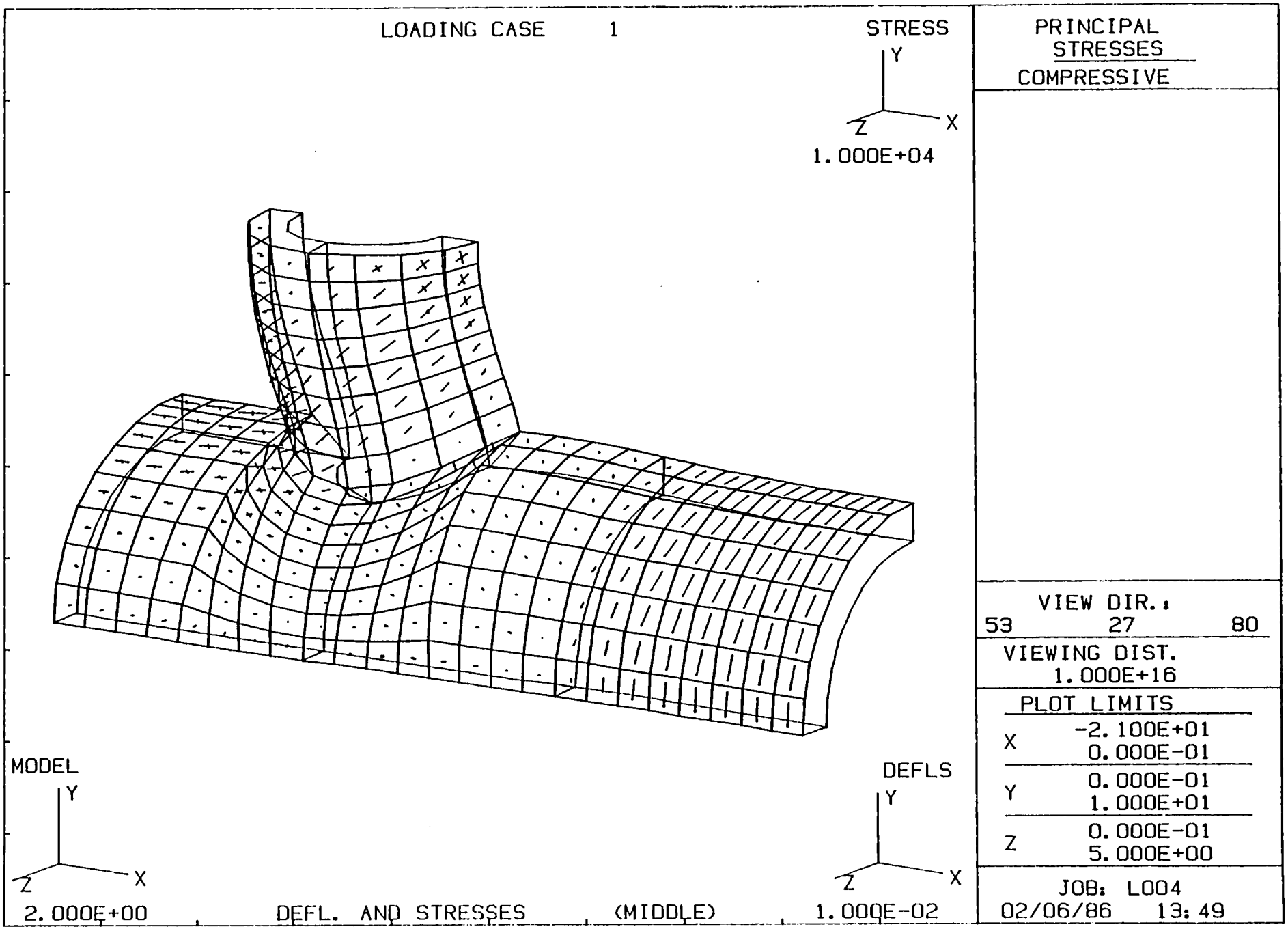
Post-Processing: Deflections Superposed on Undeflected Shapes



Post-Processing: Stress Contours on a Point Slice



Post-Processing: Tensile Stresses on a Point Slice



Post-Processing: Compressive Stresses on a Point Slice

```
INFG
JOB:L004                    02/06/86              11:40:58              PAGE  1
  NG   NAME      TYPE     BOUNDARY LINES          CNTR    SURF ELTS     STIFFNERS
                                                   PT     TYP  MN  TN DIR TYP  MN TN
   1 G1          GRID4    L56       L511                  NONE  0   0      NONE
                          L1112     L612
   2 G2          GRID4    L56       C15                   NONE  0   0      NONE
                          L12       C26
   3 G3          GRID4    L12       L17                   NONE  0   0      NONE
                          L78       L28
   4 G4          GRID4    L78       C711                  NONE  0   0      NONE
                          L1112     C812
   5 G5          GRID4    L17       C15                   NONE  0   0      NONE
                          L511      C711
   6 G6          GRID4    L28       C26                   NONE  0   0      NONE
                          L612      C812
   7 G7          GRID4    L1112     L1125                 NONE  0   0      NONE
                          L2526     L1226
   8 G8          GRID4    L78       L721                  NONE  0   0      NONE
                          L2122     L822
   9 G9          GRID4    L2122     C2125                 NONE  0   0      NONE
                          L2526     C2226
  10 G11         GRID4    C711      L721                  NONE  0   0      NONE
                          C2125     L1125
  11 G12         GRID4    C812      L822                  NONE  0   0      NONE
                          C2226     L1226
  12 G13         GRID4    L1521     C1315                 NONE  0   0      NONE
                          L1319     C1921
  13 G14         GRID4    L1920     L1319                 NONE  0   0      NONE
                          L1314     L1420
  14 G15         GRID4    C1416     L1420                 NONE  0   0      NONE
                          C2022     L1622
  15 G16         GRID4    L1516     L1521                 NONE  0   0      NONE
                          L2122     L1622
  16 G17         GRID4    L1314     C1315                 NONE  0   0      NONE
                          L1516     C1416
  17 G18         GRID4    C1921     L1920                 NONE  0   0      NONE
                          C2022     L2122
  18 G19         GRID4    L1723     C1517                 NONE  0   0      NONE
                          L1521     C2123
  19 G20         GRID4    L1622     C1618                 NONE  0   0      NONE
                          L1824     C2224
  20 G21         GRID4    L1718     L1723                 NONE  0   0      NONE
                          L2324     L1824

INFS
JOB:L004                    02/06/86              11:41:04              PAGE  1
  NS   NAME      TYPE              BOUNDARY GRIDS                          ELTYP NMAT
   1 S1          BRICK    G1        G3        G2        G5                  SLD8   1
                          G4        G6
   2 S2          BRICK    G24       G25       G9        G27                 SLD8   1
                          G26       G28
   3 S3          BRICK    G13       G15       G16       G18                 SLD8   2
                          G14       G17
   4 S4          BRICK    G7        G8        G4        G11                 SLD8   1
                          G9        G12
   5 S5          BRICK    G19       G20       G21       G23                 SLD8   2
                          G16       G22
```

Sample GIFTS Information Command Output
For Grids and Solids